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**1978 VIRUS TOLERANCE RATINGS
FOR CORN STRAINS
Grown in the Lower Corn Belt**

In cooperation with
Missouri Agricultural Experiment Station
Ohio Agricultural Research and Development Center and
Ohio Cooperative Extension Service

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Preface

In continuing research to measure corn tolerance to natural virus infection by maize dwarf mosaic and maize chlorotic dwarf, breeders and researchers grew selected corn strains in test plots in lower parts of the Corn Belt. The results of these tests are given in this publication in two parts—corn strains grown in Missouri and those grown in Ohio.

Observers of the individual corn plants rated symptoms on a scale from 1 (no virus symptoms) to 9 (complete susceptibility). Infections varied in intensity between hybrids and inbreds. At all test locations, johnsongrass, an alternate host, was abundant near the plots. The rating variations within tests of inbreds and single cross and double cross hybrids are shown in tables in this publication.

1978 Virus Tolerance Ratings of Corn Strains Grown in Missouri¹

Jack R. Wallin, Marcus S. Zuber, and Daniel V. Loonan²

This study identifies corn (*Zea mays* L.) strains evaluated in 1978 that exhibit tolerance to maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV). These results will be useful to growers for identifying hybrids with high levels of tolerance suitable for planting in areas of high virus incidence. Corn varieties were planted at two locations in Missouri. MDMV and MCDV symptoms were rated under conditions of natural infection. Test plots were located on the Bonacker Farm near House Springs, Jefferson County, and on the Delta Center Experimental Station, Portageville, Pemiscot County.

Corn inbred lines, S₁ lines, single crosses, three-way, and double crosses were planted with a four-row plot planter in single-row plots consisting of 16 plants. Plants were spaced 1 foot within each row and rows were 36 inches (91.4 cm) apart. Each plot was replicated two, three, or six times, depending upon the experiment.

¹ Cooperative investigations between the U.S. Department of Agriculture, Science and Education Administration, Agricultural Research, and the University of Missouri Agricultural Experiment Station, Columbia. Journal Series No. 8324.

² Research plant pathologist, Crop Production Research Unit, USDA-SEA-AR; professor of agronomy; and research technician, Crop Production Research Unit, USDA-SEA-AR; all University of Missouri, Columbia 65211.

Planting at Portageville was delayed until May 11 and at House Springs until May 31 because of adverse weather and to encourage high levels of virus infection from johnsongrass (*Sorghum halpense* (L.) Pers.), the alternate host for the corn virus strains involved here. Johnsongrass is abundant and grows about 79 inches (2 m) high in and around the test plots at both locations.

Virus incidence

MDMV and MCDV were identified by plant symptoms at both locations; MDMV produces a typical mosaic pattern, whereas MCDV produces vein clearing on infected leaves. Johnsongrass is an alternate host for both viruses. The corn leaf aphid, *Rhopalosiphum maidis*, and several other aphids are vectors for MDMV, which also can be transmitted mechanically. The leafhopper, *Graminella nigrifrons*, is the vector for MCDV, which cannot be transmitted mechanically.

Each plant within a plot was rated for virus symptoms on a 1 to 9 severity scale, with 1 = no symptoms and 9 = death of the plant. The ratings were made mainly for severity and not for specific types of virus. Southern inbreds were rated at about the 3-foot stage and mature-plant stage

Table 1.—Comparative virus ratings¹ for a susceptible and a tolerant single cross to virus infections for 11 years at two locations in Missouri

Location and single cross	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Average
House Springs (Jefferson County)												
Mo5xH55 (susceptible)	8.00	8.20	7.30	7.60	7.00	7.00	8.20	7.50	6.80	6.83	5.08	7.23
Mo4WxOh7B (tolerant)	1.67	5.81	4.00	4.70	2.33	1.30	3.60	1.70	4.00	2.66	3.17	3.18
Portageville (Pemiscot County)												
Mo5xH55 (susceptible)	4.67	6.33	5.33	7.00	3.67	7.00	3.70	4.50	8.40	6.65	6.16	5.76
Mo14WxOh7B (tolerant)	1.35	1.00	1.70	1.00	1.00	2.30	1.70	1.20	5.50	1.14	2.37	1.84

¹ Rating scale from 1 (no symptoms) to 9 (death of the plant).

since MDMV symptoms were more easily detected in the early rating. The plot mean analyzed was the average of the individual plant ratings. For each entry, replications were averaged to obtain an overall location rating.

MDMV was the predominant virus at both locations. The 1978 average virus rating at House Springs for the tolerant single cross, Mo14WxOh7B (11-year average 3.18) was 3.17, higher than 1977 (table 1). The susceptible single cross, Mo5XH55, rated 5.0, lower than in 1977 and lower than the 11-year average (7.23). B73xMo17 rated 4.2, in between the other two.

A Portageville, the 11-year average rating for the tolerant cross was 1.84 and the susceptible cross was 5.8. The 1978 rating for the former was just above the 11-year average and slightly lower for the latter. The single cross B73-Mo17 rated 6.1, slightly higher than the 11-year average for the other crosses.

A higher incidence of virus symptoms in field corn was generally reported from various areas of the state in 1978. Presumably, greater field stress during July and August also existed in these areas.

Commercial hybrids

Virus ratings were made on 47 commercial and 3 check hybrids at House Springs (table 2, exp. V-1) and at Portageville (table 3, exp. V-2). At House Springs, the lowest rating was 2.88 and the highest 5.08. The virus infection was greater than in 1977. In 1977, 42 hybrids rated 2.93 or less and only 1 rated less in 1978. At Portageville, virus ratings were higher than in 1977, and there was a wider range in the ratings. In 1977, the ratings ranged from 1.03 to 4.99, while in 1978 they ranged from 1.81 to 5.76. In 1977, 23 entries were rated less than 2.0, but only 2 did so in 1978. Again in 1978, there was a lack of significant differences in virus ratings between the majority of the hybrids, suggesting that commercial corn breeders are obtaining increased levels of tolerance in their hybrids.

Uniform test of southern corn inbred lines

Ten inbred lines in the Southern Corn Improvement Conference Uniform Test were grown and

Table 2.—1978 virus ratings for 47 commercial and 3 check hybrids grown on Bonacker's Farm near House Springs, Jefferson County, Mo; planted May 31; rated August 21, 1978; experiment V-1

Hybrids	Ratings	DMRT ¹
Funks CC9882	2.88	
DeKalb XL394	3.06	
Northrup King PX79	3.14	
Mo14W x OH7B ²	3.17	
Pioneer Brand 3147	3.29	
NC+ 59	3.30	
Golden Harvest XC9014	3.40	
P-A-G 266014	3.42	
ACCO AR71534	3.43	
Golden Harvest XC7034	3.44	
O's Gold TX311	3.49	
P-A-G SX17A	3.50	
DeKalb XL72B	3.55	
Pfizer Genetics MDM116	3.59	
NC+ X5288	3.63	
ACCO AR71530	3.64	
Pfizer Genetics X3342	3.65	
Funks G4848	3.66	
McCurdy 9251	3.66	
O's Gold SX5500AB	3.66	
McCurdy 77-51	3.66	
Funks 28236	3.68	
Golden Harvest H2660W	3.75	
ACCO UC9792	3.77	
McCurdy 77-26	3.81	
Northrup King PX95	3.81	
Golden Harvest H2740A	3.82	
Pioneer Brand 3179	3.83	
P-A-G 232020	3.85	
O's Gold SX3344	3.88	
Funks 28555	3.89	
ACCO UC9451	3.95	
Pfizer Genetics X3214	3.96	
P-A-G 266010	4.05	
Northrup King Px715	4.05	
O's Gold TX303	4.07	
Pfizer Genetics T1191	4.08	
McNair EXP3236	4.16	
B73 x Mo17 ²	4.18	
McNair X233	4.20	
McNair 488	4.28	
P-A-G 346	4.29	
P-A-G 99W	4.33	
NC+ 85	4.38	
NC+ 3990	4.43	
DeKalb XL62AA	4.46	
Pioneer Brand 3145	4.51	
Pioneer Brand X5505	4.65	
McCurdy 77-4	4.83	
H55 x Mo5 ²	5.08	
Coefficient of variation	15.4%	
Least significant difference, P = 0.05	0.97	
Mean rating	3.85	

¹Duncan's Multiple Range Test--Entries with the same line in common are not considered significantly different at the 5 percent level.

²Check hybrids.

rated at House Springs (table 4, exp. V-3 and table 5, exp. V-4). The inbreds were rated July 17 and August 21. In the early rating, MDMV symptoms were more pronounced with little or no MCDV symptoms apparent. The late rating included the combined symptoms of both viruses. In the early rating for MDMV, SC229, T143,

Table 3.—1978 virus ratings for 47 commercial and 3 check hybrids grown at the Delta Center near Portageville, Pemiscot County, Mo; planted May 11; rated August 1, 1978; experiment V-2

Hybrids	Ratings	DMRT ¹
DeKalb XL72B	1.81	
DeKalb XL394	1.92	
Funks 28236	2.00	
Funks CC9882	2.18	
Pioneer Brand 3147	2.34	
Mo14W x OH7B ²	2.37	
ACCO AR71530	2.44	
Pfizer Genetics MDM116	2.48	
Pfizer Genetics X3214	2.52	
Golden Harvest H2740A	2.53	
P-A-G 232020	2.53	
P-A-G SX17A	2.54	
McCurdy 77-26	2.57	
Pfizer Genetics T1191	2.71	
Funks G4848	2.76	
Pioneer Brand 3145	2.95	
McCurdy 77-4	2.96	
McCurdy 77-51	2.97	
Golden Harvest XC9014	3.07	
Northrup King PX79	3.08	
ACCO UC9792	3.19	
Pioneer Brand X5505	3.20	
McNair EXP3236	3.26	
P-A-G 266014	3.26	
NC+ X5288	3.36	
McNair X233	3.40	
O's Gold SX3344	3.44	
DeKalb XL62AA	3.51	
Funks 28555	3.65	
P-A-G 346	3.67	
Golden Harvest XC7034	3.74	
Golden Harvest H2660W	3.74	
Pfizer Genetics X3342	3.76	
Pioneer Brand 3179	3.77	
Northrup King PX715	3.80	
ACCO AR71534	3.82	
P-A-G 266010	3.94	
P-A-G 99W	3.96	
NC+ 59	4.56	
NC+ 85	4.61	
McNair 488	4.90	
Northrup King PX95	5.05	
NC+ 3990	5.17	
O's Gold SX5500AB	5.17	
O's Gold TX303	5.24	
McCurdy 9251	5.31	
ACCO UC9451	5.60	
O's Gold TX311	5.76	
B73 x Mo17 ²	6.10	
H55 x Mo5 ²	6.16	
Coefficient of variation		28.5%
Least significant difference, P = 0.05		1.66
Mean rating		3.58

¹Duncan's Multiple Range Test--Entries with the same line in common are not considered significantly different at the 5 percent level.

²Check hybrids.

Table 4.—Combined 1978 virus ratings for 47 commercial and 3 check hybrids grown at House Springs and Portageville, Mo.

Hybrids	Ratings	DMRT ¹
DeKalb XL394	2.49	
Funks CC9882	2.53	
DeKalb XL72B	2.68	
Mo14W x OH7B ²	2.77	
Pioneer Brand 3147	2.81	
Funks 28236	2.84	
P-A-G SX17A	3.02	
Pfizer Genetics MDM116	3.04	
ACCO AR71530	3.04	
Northrup King PX79	3.11	
Golden Harvest H2740A	3.18	
P-A-G 232020	3.18	
McCurdy 77-26	3.19	
Funks G4848	3.21	
Golden Harvest XC9014	3.23	
Pfizer Genetics X3214	3.24	
McCurdy 77-51	3.33	
P-A-G 266014	3.34	
Pfizer Genetics T1191	3.40	
ACCO UC9792	3.48	
NC+ X5288	3.49	
Golden Harvest XC7034	3.59	
ACCO AR71534	3.63	
O's Gold SX3344	3.66	
Pfizer Genetics X3342	3.70	
McNair EXP3236	3.71	
Pioneer Brand 3145	3.73	
Golden Harvest H2660W	3.75	
Funks 28555	3.77	
McNair X233	3.80	
Pioneer Brand 3179	3.80	
McCurdy 77-4	3.90	
Pioneer Brand X5505	3.92	
Northrup King PX715	3.93	
NC+ 59	3.93	
P-A-G 346	3.98	
DeKalb XL62AA	3.99	
P-A-G 266010	4.00	
P-A-G 99W	4.14	
O's Gold SX5500AB	4.42	
Northrup King PX95	4.43	
McCurdy 9251	4.49	
NC+ 85	4.49	
McNair 488	4.59	
O's Gold TX311	4.62	
O's Gold TX303	4.65	
ACCO UC9451	4.78	
NC+ 3990	4.80	
B73 x Mo17 ²	5.14	
H55 x Mo5 ²	5.62	
Coefficient of variation	22.4%	
Least significant difference, P = 0.05	1.49	
Mean rating	3.70	

¹Duncan's Multiple Range Test--Entries with the same line in common are not considered significantly different at the 5 percent level.

²Check hybrids.

GA209, OH513, T240 and TX601, which rated between 1.37 and 1.93, were significantly more tolerant than the others. In the later rating for both viruses, GA209, T143, TX601, T240 and SC229, all between 1.9 and 2.37, were significantly more tolerant than the others. Five of the same inbreds had the greatest tolerance on both dates.

Table 5.—July 17, 1978, virus ratings for inbred lines in the Southern Corn Improvement Conference Uniform Test grown on Bonacker's Farm near House Springs in Jefferson County, Mo; planted May 31; experiment V-3

Inbred	Ratings	DMRT ¹
SC229	1.37	
T143	1.39	
GA209	1.70	
OH513	1.87	
T240	1.87	
TX601	1.93	
T232	2.05	
KY21	2.57	
Mo43	2.98	
MP490	3.39	
Coefficient of variation	13.9%	
Least significant difference, P = 0.05	0.48	
Mean rating	2.11	

¹Duncan's Multiple Range Test--Entries with the same line in common are not considered significantly different at the five percent level.

PR-Mo2 mass selections for virus tolerance

Eight derivatives of the composite corn strain PR-Mo2 were rated for their response to MDMV and MCDV at House Springs (table 6, exp. V-5). PR-Mo2 unselected and PR-Mo2(M-V)_C₂ have been mass selected from an open-pollinated plot for 3 years. They rated more resistant than any of the commercial hybrids at the same location. PR-Mo2 from the original seed stock was not selected for virus tolerance but seemed to have tolerance to the viruses. Only PR-Mo2 (MoSQB)_S₁_C₁ made progress under selection for reduced virus incidence. Mass selection in open-pollinated plots subjected to natural virus infection will be continued.

Conclusions

Virus symptoms and the infection level were more severe in 1978 than in 1977, but less than 1976, which was one of the worst years at both test sites noted herein. Presumably, meteorological variables were more favorable for virus development in July and August. The data indicate the degree of difference in tolerance between corn strains. A potential virus threat exists wherever

Table 6.—August 21, 1978, virus ratings for inbred lines in the Southern Corn Improvement Conference Uniform Test grown on Bonacker's Farm, near House Springs in Jefferson County, Mo; planted May 31; experiment V-4

Inbred	Ratings	DMRT ¹
GA209	1.90	
T143	2.11	
TX601	2.33	
T240	2.36	
SC229	2.37	
OH513	2.92	
T232	3.00	
Mo43	3.18	
KY21	4.30	
MP490	4.41	
Coefficient of variation		18.2%
Least significant difference, P = 0.05		0.86
Mean rating		2.89

¹Duncan's Multiple Range Test--Entries with the same line in common are not considered significantly different at the five percent level.

johnsongrass grows; therefore, corn growers should select hybrids with the high levels of virus tolerance. Note from the data relating to the commercial hybrids reported here, several hybrids had levels of tolerance that should be suitable for planting in virus-problem areas.

Table 7.—1978 virus ratings for PR-Mo2 lines grown on Bonacker's Farm near House Springs in Jefferson County, Mo; planted May 31; rated August 21; experiment V-5

Inbred	Ratings	DMRT ¹
PR-Mo2(M-V)C ₂	1.79	
(PR-Mo2)(MoSQB)S ₁ C ₁	1.82	
(PR-Mo2)S ₁ C ₁	1.85	
PR-Mo2(M-V)C ₁	1.85	
PR-Mo2 unselected	2.25	
PR-Mo2 x MoSQB unsel.	2.60	
PR-Mo2 x MoSQA unsel.	2.62	
(PR-Mo2 x MoSQA)S ₁ C ₁	2.69	
Coefficient of variation		18.8%
Least significant difference, P = 0.05		0.47
Mean rating		2.18

¹Duncan's Multiple Range Test--Entries with the same line in common are not considered significantly different at the five percent level.

Corn breeders have been quite successful in developing new hybrids with greater tolerances. During the past 8 years, the number of commercial hybrids with high levels of tolerance has increased.

Virus Tolerance Ratings of Corn Strains Grown in Ohio in 1978¹

William R. Findley, John K. Knoke and Elwood J. Dollinger²

Inbred lines and hybrids were grown in the Ohio river valley near Portsmouth on the farm of Jim Daulton and rated for virus diseases resulting from natural infection.

Inbred line tests were sponsored by the Ohio Agricultural Research and Development Center (OARDC) and by the North Central Corn Breeding Research Committee (NCCBRC). A hybrid test was conducted cooperatively with OARDC and the Ohio Cooperative Extension Service.

Seeds of the corn strains were mechanically planted in replicated plots on May 25 or 26, 1978. Plots were 19 feet long with 2 feet aisles between plots in the inbred tests and 3 feet aisles in the hybrid tests and rows 36 inches apart. Twenty-five seeds of each inbred line were planted per one-row plot. Seeds of each hybrid were planted in two-row plots, 60 seeds per row, and later thinned to 34 plants. Inbreds were grown in two replications; hybrids in four replications.

Seedling emergence generally was good, resulting in satisfactory stands in nearly all plots. Seeds planted in cloddy areas that resulted from the soil being worked when wet did not germinate until showers were received during the week of June 5. Relatively dry weather prevailed from July 9 to July 23, but rainfall was adequate

to excessive during the remainder of the season. Temperatures averaged normal to above normal for the season. Weeds were controlled throughout the growing season by herbicides and cultivation.

Virus incidence

Maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV) infection in trap plants averaged 48.3 and 2.0 percent, respectively, from early May through August. MDMV and MCDV infection averaged about 39 percent higher and 6 percent lower in 1978 than in 1977 but 25 and 70 percent lower than in 1976, respectively. First MDMV infection appeared in the trap plants the week ending May 25; MCDV appeared 2 weeks later. The susceptible trap plants were potted 14-day-old WF9xOh51A seedlings exposed for 7-day periods throughout the growing season.

Aphid populations as measured by yellow pan-water traps averaged 89 percent less in 1978 than in 1977 through mid-July and 56 percent less for the 16 week collection period. However, the aphids were about three times more effective vectors of MDMV in 1978 than in 1977. For each aphid trapped in 1978, an average of 1.2 percent infection appeared in the trap plants, while only 0.4 percent infection was apparent in 1977. Populations of the leafhopper vector of MCDV were not sampled near this test site in 1978. However, at a sample site in northern Ohio, populations of this vector averaged 34 percent less in 1978 than in 1977.

Average ratings of 37 inbred lines included in the 1977 and 1978 tests were 28.9 and 17.9 percent for MDMV, 62.3 and 41.5 percent for MCDV, and 5.3 and 3.5 for virus ratings, respectively.

¹ Cooperative investigations of USDA-SEA-AR; the Ohio Agricultural Research and Development Center, Wooster; and the Ohio Cooperative Extension Service, Columbus.

² Research agronomist and research entomologist, USDA-SEA-AR, and professor of agronomy, OARDC, Wooster, Ohio 44691.

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Virus rating systems

Two systems for evaluating effects of the viruses were established. In the first system, disease incidence in the test entry was determined. Observations for symptoms of MDMV and MCDV were made on individual plants in the inbred line tests on July 12. Individual plants in the hybrid test were observed for symptoms of MDMV and MCDV on August 8. Symptoms of MDMV were chlorotic patterns of mosaic, rings, flecks, streaks, or mottle. The diagnostic symptom of MCDV was chlorotic streaking in the smallest leaf veins. Severe symptoms of one virus often masked symptoms of the other.

In the second ratings system disease severity was determined. Virus ratings were made on the inbred lines on August 22 and the hybrids on August 23. Plants were rated on a plot basis. Virus ratings that included degrees of stunting and chlorosis were made on a scale ranging from 1 (no visible virus symptoms) to 9 (severe symptoms). Plant stunting was not associated with ratings of 3 or less. Plants rated 2 were faintly chlorotic and those rated 3 were distinctly chlorotic. Ratings of 4 to 9 indicated increasing degrees of stunting and chlorosis.

Duncan's New Multiple Range Test permits making any possible combination of mean comparisons. Entries that do not have the same letter in common differ significantly at the 5 percent level. Least significant differences (LSD) at the 5 percent probability level and coefficient of variation (CV) values were also computed. The LSD is useful in comparing entries with a common standard or adjacent means. Differences in the mean values that exceed the LSD are significant statistically 19 times in 20. The CV is a good indicator of test uniformity—the lower the CV the greater the degree of test uniformity.

Inbred evaluation

Percentages of MDMV- and MCDV-infected plants and mean plot virus ratings of the 69 lines in the OARDC test are in tables 8, 9, and 10, respectively. Many of the inbreds were tested in

several previous years. A number of the inbreds appeared to have an acceptable level of tolerance to MDMV although the range of statistical significance was large. Ranges of statistical significance were also large for percentages of MCDV-infected plants and virus ratings. Considering the three traits evaluated, inbreds with most promise were Oh74-5232, (Oh7B-Pa884PxPD(MS)6xTuxpeno)-S³, N6J, Ky66-2500, Oh5145, T143, T(CM105), (B14A-B37xPD(MS)6xTuxpeno)-S³ and Oh7B. Only nine plants were available to evaluate inbred Oh74-5232.

Tables 11, 12, and 13 report percentages of MDMV- and MCDV-infected plants and mean plot virus ratings, respectively, on the 52 inbred lines in the NCCBRC test. Except for the standard inbreds (W117, W153R, Oh43, W64A, B14, B37, B73, Mo17 and Oh7B), the entries were advanced experimental lines from various states. Inbred Mo20W ranked first in this test for each attribute. Inbreds Oh7B, CH591-36, and Oh5145, had good virus ratings and low percentages of MDMV- and MCDV-infected plants.

Hybrid evaluation

Results of the hybrid test are reported in tables 14, 15, and 16 for percentages of MDMV- and MCDV-infected plants and mean plot virus ratings, respectively. Included were 36 (available and experimental) proprietary hybrids and 10 open-pedigree combinations. Several hybrids appeared to have good tolerance to both viruses.

Conclusions

The virus disease in southern Ohio is known to consist of MCDV and several strains of MDMV. Reaction of corn strains to these viruses is related to their degree of tolerance. Plants of susceptible inbred lines and hybrids become stunted and chlorotic with low levels of virus concentration. Much higher levels of virus concentration appear to be required to induce stunting and chlorosis in highly tolerant genotypes. Very early infections may produce severe reactions, even in highly tolerant genotypes.

Table 8.—Incidence of maize dwarf mosaic virus (MDMV) on inbred lines in the Ohio Agricultural Research and Development Center test on July 12, 1978

Inbred	MDM-Percent	
Oh07	0	a ¹
Oh513	0	a
Tx601	0	a
Oh5145	0	a
Oh74-5232	0	a
T (CM105)	0	a
(Oh7B-Pa884PxPD(MS) 6xTuxpeno) -S ³	0	a
N6J	0	a
JSA52-2	0	a
Ky66-2500	0	a
BSB(SV) C5 (185) -S6-2	0	a
Oh7B	0	a
Oh (MDM) S2-# ⁴ -S-#-S-S (6B)	2.1	ab
BS8 (SV) C5 (185) -S6-3	2.2	ab
Oh (MDM) S2-# ⁴ -S-#-S-S (69)	2.3	ab
Oh509	2.4	ab
Oh (MDM) S2-# ⁴ -S-#-S-S (67)	2.4	ab
Ky226	2.4	ab
Oh509 ⁷ Ht	2.6	ab
(B14A-B37xPD(MS) 6xTuxpeno) -S ³	3.6	ab
T143	3.6	ab
Mo20W	4.0	ab
GT3	4.4	ab
N7B	4.5	ab
T232	4.7	ab
N6	6.6	ab
33-16	6.7	ab
Ky61-2335	7.6	ab
T240	8.3	ab
CI. 38B Rec.	8.7	ab
Oh (MDM) S1-#-S-#-S-#-S-S (73)	9.1	a-c
Va94	11.8	a-d
Pa884P	12.1	a-d
BS8 (SV) C5 (185) -S6-5	12.3	a-d
GA203	12.5	a-d
A73	12.7	a-d
CG1	13.7	a-d
E14-2-9	13.8	a-d
Oh (MDM) S1-#-S-#-S-#-S-S (71)	15.7	a-d
CI. 38B	15.8	a-d
Oh (MDM) S1-#-S-#-S-#-S-S (72)	16.2	a-d
Ky128	16.7	a-d
GA209	19.4	a-e
J62-31B	20.0	a-f
A96	21.2	a-g
B14A	21.6	a-g
Mo12	21.8	a-g
Oh514	23.4	a-g
B54	23.8	a-g
Va35	24.6	a-g
H95	25.6	a-g
Oh (MDM) S2-# ⁴ -S-#-S-S (70)	28.5	b-g
Va93	28.7	b-g
K61-1	28.9	b-g
B37	35.7	c-h
B79	37.0	d-h
AS09	43.6	e-i
Mo17	44.1	e-i
B73	46.3	f-j
Mo5	47.0	g-j
Oh509A	47.9	g-k
A	55.2	h-l
C103	59.5	h-l
B77	61.3	h-l
M14	63.8	i-l
Oh43	71.0	j-l
Oh2B	72.8	k-l
Oh2B	73.4	k-l
Oh28	74.2	l
Coefficient of variation	56.8%	
Least significant difference	22.0	

¹Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 9.—Incidence of maize chlorotic dwarf virus (MCDV) on inbred lines in the Ohio Agricultural Research and Development Center test on July 12, 1978

Inbred	MCD-Percent	
Oh74-S232	0	a ¹
(B14A-B37xPD(MS) 6xTuxpeno) -S ³	3.6	ab
(Oh7B-Pa884PxPD(MS) 6xTuxpeno) -S ³	6.8	a-c
T143	7.1	a-d
N6J	7.5	a-d
Ky66-2500	9.5	a-d
Oh5145	10.5	a-d
Mo20W	14.8	a-e
T (CM105)	14.8	a-e
Tx601	15.0	a-e
Oh7B	16.1	a-f
GT3	17.9	a-g
Oh (MDM) S1-#-S-#-S-#-S-S (72)	19.3	a-h
Oh509	20.5	a-i
Oh513	22.2	a-i
BS8 (SV) C5 (195) -S6-2	22.4	a-j
Oh07	23.4	a-j
CI. 38B	27.2	a-k
CI. 38B Rec.	27.2	a-k
Pa884P	27.5	a-k
BS8 (SV) C5 (185) -S6-3	27.7	a-k
Mo12	28.0	a-k
Oh509 ⁷ Ht	28.3	a-k
Oh (MDM) S2-# ⁴ -S-#-S-S (69)	29.5	a-k
Oh (MDM) S2-# ⁴ -S-#-S-S (6B)	30.0	a-k
T232	30.9	a-k
33-16	32.6	a-k
AS09	33.0	a-k
N6	35.2	a-l
JSA52-2	35.7	a-l
T240	36.1	a-l
E14-2-9	36.5	a-l
Oh (MDM) S1-#-S-#-S-#-S-S (71)	38.9	a-m
B77	39.3	a-m
GA203	39.6	a-m
B14A	39.7	a-m
Oh (MDM) S2-# ⁴ -S-#-S-S (67)	41.4	a-m
H95	41.8	a-m
B79	42.3	b-n
Va94	42.6	b-n
Oh (MDM) S1-#-S-#-S-#-S-S (73)	42.9	b-n
GA209	42.9	b-n
BS8 (SV) C5 (185) -S6-5	45.3	b-o
Ky226	47.5	c-o
Ky61-2335	48.6	c-p
A73	48.8	d-p
Oh514	53.5	e-q
CG1	55.8	e-q
A96	57.0	f-q
B73	57.0	f-q
Ky128	58.3	g-q
B54	58.7	g-q
K61-1	60.5	h-q
B37	61.9	i-q
N71B	62.3	i-q
Mo17	64.2	j-q
Oh (MDM) S2-# ⁴ -S-#-S-S (70)	64.3	j-q
C103	66.7	k-q
Oh43	68.1	k-q
J62-318	68.1	k-q
M14	76.1	l-q
Va35	79.6	m-q
Oh509A	80.6	m-q
Va93	83.8	n-q
Mo5	85.2	o-q
A	85.9	o-q
Oh28	90.0	p-q
Oh28	92.5	q
Oh28	93.7	q
Coefficient of variation	40.8%	
Least significant difference	34.2	

¹Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 10.—Virus ratings on inbred lines in the Ohio Agricultural Research and Development Center test on August 22, 1978

Inbred	Virus rating ¹
T (CM105)	1.0 a ²
N6J	1.5 ab
Oh74-5232	1.5 ab
(B14A-B37xPD (MS) 6xTuxpeno) -S ³	1.5 ab
Oh7B	1.5 ab
Oh513	1.5 ab
T143	1.5 ab
Ky66-2500	2.0 a-c
Oh5145	2.0 a-c
BS8 (SV) C5 (185) -S6-2	2.0 a-c
Oh514	2.0 a-c
Oh509	2.0 a-c
Oh07	2.0 a-c
GT3	2.0 a-c
(Oh7B-Pa884PxPD (MS) 6xTuxpeno) -S ³	2.0 a-c
JSA52-2	2.5 a-d
Oh (MDM) S1-#-S-#-S-#-S-S (72)	2.5 a-d
Mo20W	2.5 a-d
Mo12	2.5 a-d
T240	2.5 a-d
GA209	2.5 a-d
H95	2.5 a-d
BS8 (SV) C5 (185) -S6-3	2.5 a-d
Ky61-2335	2.5 a-d
T232	2.5 a-d
Tx601	2.5 a-d
Oh (MDM) S1-#-S-#-S-#-S-S (73)	3.0 a-e
BS8 (SV) C5 (185) -S6-5	3.0 a-e
Ky226	3.0 a-e
B54	3.0 a-e
K61-1	3.0 a-e
CI. 38B Rec.	3.0 a-e
Va94	3.5 b-f
Oh509 ⁷ Ht	3.5 b-f
N7B	3.5 b-f
N6	3.5 b-f
Pa884P	4.0 c-g
Oh (MDM) S2-# ⁴ -S-#-S-S (70)	4.0 c-g
Ky128	4.0 c-g
Oh (MDM) S2-# ⁴ -S-#-S-S (68)	4.0 c-g
Oh (MDM) S2-# ⁴ -S-#-S-S (67)	4.0 c-g
CG1	4.5 d-h
Oh (MDM) S2-# ⁴ -S-#-S-S (69)	4.5 d-h
GA203	4.5 d-h
A509	4.5 d-h
J62-318	5.0 e-i
B79	5.0 e-i
B77	5.0 e-i
33-16	5.0 e-i
Oh (MDM) S1-#-S-#-S-#-S-S (71)	5.5 f-j
A96	5.5 f-j
Va35	5.5 f-j
CI03	5.5 f-j
Mo17	5.5 f-j
A73	5.5 f-j
CI. 38B	5.5 f-j
B37	6.0 g-k
Oh509A	6.0 g-k
Mo5	6.5 h-l
B14A	6.5 h-l
E14-2-9	7.0 i-l
M14	7.0 i-l
Oh43	7.0 i-l
A	7.5 j-l
Va93	7.5 j-l
Oh28	7.5 j-l
B73	7.5 j-l
Oh28	8.0 k-l
Oh28	8.5 l
Coefficient of variation	25.6%
Least significant difference	2.0

¹Virus rated on a 1 to 9 scale, with 1 = no symptoms and 9 = severe symptoms.

²Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 11.—Incidence of maize dwarf mosaic virus (MDMV) on inbred lines in the North Central Corn Breeding Research Committee uniform test on July 12, 1978

Inbred	MDM-Percent
Oh7015	0 a ¹
Mo20W	0 a
N171	2.2 a
N169	2.4 a
Oh6515	2.8 ab
A75-4	3.3 ab
Oh6505	3.6 ab
N173	4.3 a-c
N170	4.3 a-c
Oh5145	4.5 a-c
Oh7B	4.5 a-c
CH591-36	4.6 a-c
Pa72-1	6.7 a-d
N172	7.7 a-e
Pa72-2	8.7 a-f
W540	14.7 a-g
A75-1	14.8 a-g
Mich.77-4	16.0 a-h
B14	17.9 a-i
CH593-9	20.5 a-j
Pa72-7	21.4 a-k
Pa71-46	24.6 a-l
Mich.77-2	24.6 a-l
Pa72-10	24.7 a-l
A75-3	25.1 a-l
Mo17	26.5 a-l
B37	31.0 a-l
W117	33.0 a-m
ND76-6	34.1 a-m
ND76-3	36.9 b-m
N168	38.0 c-m
SD541-235	39.7 d-m
W546	40.5 d-m
W182N	41.0 e-m
ND76-4	42.9 f-n
Pa71-49	43.3 g-n
Mich.77-3	45.0 g-n
B73	46.7 g-n
W845	48.1 g-n
W538	48.2 g-n
SD549-4	49.5 h-n
CH663-8	50.0 h-n
Mich.77-1	51.0 i-n
W544	53.1 j-n
W64A	54.3 j-n
CH671-28	54.5 j-n
Pa71-55	55.2 k-n
SD543-432	56.3 l-n
W153R	58.1 l-n
W406	66.9 m-n
SD550-2	75.2 n
Oh43	76.7 n
Coefficient of variation	46.6%
Least significant difference	27.9

¹Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 12.—Incidence of maize chlorotic dwarf virus (MCDV) on inbred lines in the North Central Corn Breeding Research Committee uniform test on July 12, 1978

Inbred	MCD-Percent	
Mo20W	4.4	a 1
Oh7B	9.1	ab
Pa72-2	13.0	a-c
CH591-36	15.4	a-d
Oh7015	15.6	a-d
Oh5145	18.4	a-e
CH671-28	20.8	a-e
A75-4	25.2	a-f
Oh6515	25.8	a-f
N169	29.7	a-g
ND76-6	31.0	a-h
Mich.77-4	31.3	a-h
Pa72-1	32.1	a-i
Oh6505	32.9	a-i
Mo17	34.2	a-j
N170	34.8	a-j
Mich.77-2	35.7	a-j
N171	35.8	a-j
B14	40.0	a-k
Pa72-10	41.7	a-k
N173	42.6	a-k
CH663-8	44.4	a-k
A75-1	45.8	a-k
N168	46.3	a-k
N172	48.1	b-l
ND76-3	48.2	b-l
ND76-4	53.1	c-m
W546	54.8	c-m
W544	55.3	c-m
Pa71-49	56.3	d-m
Pa71-55	57.3	d-m
B73	57.5	d-m
W117	57.9	d-m
A75-3	58.3	d-m
CH593-9	60.3	e-m
W538	61.3	e-m
W540	63.9	f-m
B37	65.1	f-m
W406	65.3	f-m
W845	66.5	f-m
Mich.77-1	72.2	q-m
Mich.77-3	72.2	g-m
Pa71-46	72.9	h-m
SD549-4	74.6	i-m
W64A	76.8	j-m
W153R	79.4	k-m
Pa72-7	80.0	k-m
SD541-235	80.1	k-m
SD543-432	89.4	l-m
SD550-2	90.0	l-m
Oh43	90.0	l-m
W182N	92.1	m
Coefficient of variation	35.0%	
Least significant difference	35.1	

¹Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 13.—Virus ratings on inbred lines in the North Central Corn Breeding Research Committee uniform test on August 22, 1978

Inbred	Virus rating ¹	
Mo20W	1.5	a 2
Oh7B	2.0	ab
Oh5145	2.0	ab
CH591-36	2.0	ab
A75-1	2.5	a-c
Pa72-1	2.5	a-c
Oh7015	2.5	a-c
Pa72-2	2.5	a-c
Oh6515	3.0	a-d
Oh6505	3.0	a-d
Pa72-10	3.5	a-e
ND76-6	3.5	a-e
N169	3.5	a-e
A75-4	3.5	a-e
ND76-4	3.5	a-e
Mich.77-4	3.5	a-e
N171	3.5	a-e
N172	4.0	a-f
N170	4.0	a-f
W117	4.0	a-f
N173	4.0	a-f
Mich.77-3	4.0	a-f
W845	4.5	a-g
Pa71-46	4.5	a-g
W538	4.5	a-g
Mo17	4.5	a-g
CH671-28	4.5	a-g
CH593-9	4.5	a-g
Pa71-49	5.0	b-h
B37	5.0	b-h
Pa71-55	5.0	b-h
N168	5.0	b-h
W406	5.0	b-h
ND76-3	5.0	b-h
Mich.77-2	5.5	c-h
Mich.77-1	5.5	c-h
W546	5.5	c-h
Pa72-7	5.5	c-h
A75-3	6.0	g-h
W544	6.0	d-h
CH663-8	6.0	d-h
W64A	6.5	e-h
SD549-4	6.5	e-h
B73	7.0	f-h
B14	7.0	f-h
W540	7.0	f-h
W182N	7.0	f-h
W153R	7.0	f-h
SD543-432	7.5	g-h
SD550-2	8.0	h
Oh43	8.0	h
SD541-235	8.0	h
Coefficient of variation	26.7%	
Least significant difference	2.5	

¹Virus rated on a 1 to 9 scale, with 1 = no symptoms and 9 = severe symptoms.

²Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 14.—Incidence of maize dwarf mosaic virus (MDMV) on commercial and open-pedigree hybrids on August 8, 1978

Hybrid	MDM-Percent	
(Oh509AxOh7B)xH95 OFS	0	a ¹
Madison Exp. E	0	a
Oh5145xOh514	0	a
PAG SX17A	0	a
Oh509AxOh5145	0	a
PAG Exp. 266014	.4	a
PAG 232020	.4	a
Ruff R434	.4	a
DeKalb XL72B	.4	a
Landmark C787XX	.4	a
Ferry-Morse X990	.7	a
Oh509AxA239 OFS	.7	a
Baldrige Exp. 4100	.7	a
Kenworthy KL-X73	.8	a
(Oh509AxOh514)xH95 OFS	.9	a
Ruff R444	1.1	ab
Mol7xOh509 ⁷ Ht	1.1	ab
Voris 2502	1.1	ab
O.Y.O 5125	1.2	ab
Northrup King PX79-24597	1.2	ab
Pioneer X5505	1.4	ab
Pioneer 3179	1.4	ab
Kenworthy KL-708L	1.5	ab
Pioneer 3147	1.7	ab
Oh517xOh5145	1.9	ab
Akin XA3908	2.0	ab
PAG 99W	2.2	ab
Baldrige 335	2.3	ab
Columbiana H-2660W	2.3	ab
Baldrige Exp. 4800	3.0	ab
Pioneer 3145	3.8	a-c
Columbiana H-2740A	4.0	a-c
Acco UC9792	4.3	a-c
PAG 644W	4.5	a-c
(Oh7BxMol2) (CI.38BxVa35)	4.8	a-d
H95xVa53 OFS	5.0	a-d
Baldrige Exp. 4450	5.3	a-d
PAG SX346	8.4	a-d
Baldrige MDM#8	8.6	a-d
Northrup King PX95-25037	11.4	a-e
Ferry-Morse X980	13.6	b-f
Kenworthy KL-X75	15.6	c-f
Ferry-Morse 74-174	16.6	d-f
Acco UC8951	20.6	e-f
Northrup King PX715-20564	24.0	f
WF9xOh51A	59.3	g
Coefficient of variation	138.9%	
Least significant difference	10.2	

¹Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 15.—Incidence of maize chlorotic dwarf virus (MCDV) on commercial and open-pedigree hybrids on August 8, 1978

Hybrid	MCD-Percent	
DeKalb XL72B	5.9	a ¹
O.Y.O 5125	9.6	ab
(Oh509AxOh7B)xH95 OFS	9.7	ab
Landmark C787XX	10.2	ab
PAG SX17A	11.2	a-c
Voris 2502	11.4	a-c
(Oh509AxOh514)xH95 OFS	11.5	a-c
Madison Exp. E	12.2	a-d
Oh509AxOh5145	12.3	a-d
Baldrige Exp. 4100	12.3	a-d
Kenworthy KL-X73	13.1	a-e
Pioneer 3179	13.2	a-e
Baldrige 335	14.0	a-e
Ruff R444	14.7	a-e
Oh5145xOh514	15.1	a-f
Oh509AxA239 OFS	15.2	a-f
Ruff R434	16.1	a-f
H95xVa53 OES	16.2	a-g
Mol7xOh509 ⁷ Ht	16.6	a-g
Baldrige Exp. 4800	16.8	a-g
Northrup King PX79-24597	16.9	a-g
Columbiana H-2660W	18.1	a-g
Akin XA3908	19.8	a-h
PAG 232020	20.0	a-h
Pioneer X5505	20.3	a-h
Pioneer 3147	20.5	a-h
Pioneer 3145	21.1	a-h
Oh517xOh5145	21.1	a-h
Acco UC9792	21.7	a-h
Kenworthy KL-708L	21.7	a-h
PAG Exp. 266014	26.9	a-h
Ferry-Morse X990	27.0	a-h
Baldrige Exp. 4450	28.5	b-h
(Oh7BxMol2) (CI.38BxVa35)	33.0	c-i
Acco UC8951	34.1	d-j
PAG SX346	34.8	e-j
Columbiana H-2740A	34.8	e-j
Ferry-Morse 74-174	35.2	e-j
Ferry-Morse X980	37.0	f-j
Kenworthy KL-X75	37.2	f-j
Baldrige MDM#8	38.3	g-j
Northrup King PX95-25037	40.3	h-j
PAG 99W	40.9	h-j
Northrup King PX715-20564	50.0	i-k
PAG 644W	55.3	j-k
WF9xOh51A	65.3	k
Coefficient of variation	54.6%	
Least significant difference	17.9	

¹Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

Table 16.—Virus ratings on commercial and open-pedigree hybrids on August 23, 1978

Hybrid	Virus rating ¹	
Pioneer 3179	2.0	a ²
PAG SX17A	2.0	a
Madison Exp. E	2.3	ab
(Oh509AxOh7B)xH95 OFS	2.3	ab
Landmark C787XX	2.5	a-c
Kenworthy KL-X73	2.5	a-c
PAG 232020	2.5	a-c
DeKalb XL72B	2.5	a-c
Pioneer X5505	2.5	a-c
Ruff R444	2.5	a-c
(Oh509AxOh514)xH95 OFS	2.5	a-c
Northrup King PX79-24597	2.5	a-c
Mo17xOh509 ⁷ Ht	2.8	a-d
O.Y.O 5125	2.8	a-d
Oh5145xOh514	2.8	a-d
Baldrige 335	2.8	a-d
Oh509AxOh5145	2.8	a-d
Pioneer 3147	2.8	a-d
Akin XA3908	2.8	a-d
Oh509xA239 OFS	2.8	a-d
H95xVa53 OFS	2.8	a-d
Voris 2502	3.0	a-e
Oh517xOh5145	3.0	a-e
Columbiana H-2740A	3.0	a-e
Columbiana H-2660W	3.0	a-e
(Oh7BxMo12)(CI38BxVa35)	3.3	a-e
Baldrige Exp.4100	3.3	b-f
Ruff R434	3.3	b-f
PAG Exp. 266014	3.3	b-f
PAG 99W	3.3	b-f
PAG SX346	3.5	c-g
Kenworthy KL-708L	3.5	c-g
Pioneer 3145	3.5	c-g
Acco UC9792	3.5	c-g
Baldrige Exp. 4800	3.5	c-g
Baldrige Exp. 4450	3.5	c-g
Baldrige MDM#8	3.5	c-g
Ferry-Morse X990	3.5	c-g
PAG 644W	3.8	d-g
Ferry-Morse X980	4.0	e-g
Kenworthy KL-X75	4.0	e-g
Acco UC8951	4.3	f-g
Ferry-Morse 74-174	4.3	f-g
Northrup King PX95-25037	4.3	f-g
Northrup King PX715-20564	4.5	g
WF9xOh51A	5.5	h
Coefficient of variation	21.7%	
Least significant difference	.95	

¹Virus rated on a 1 to 9 scale, with 1 = no symptoms and 9 = severe symptoms.

²Duncan's Multiple Range Test--Entries with the same letter in common are not considered significantly different at the 5 percent level.

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